

VTT Technical Research Centre of Finland

## Biopohjaiset materiaalit muovin korvaajina

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# Biopohjaiset materiaalit muovin korvaajina

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VTT Technical Research Centre of Finland Ltd

**Muovihaastetta taklaamassa –aamiaistilaisuus 28.9.2018**





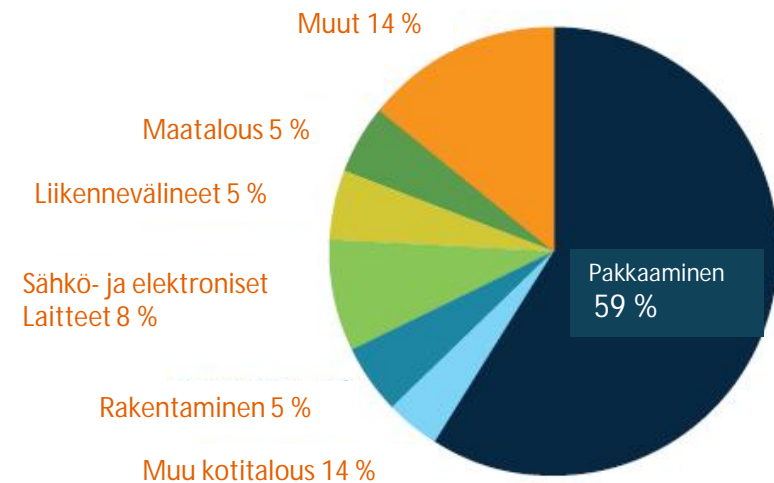
## Plastics - A social necessity

- Non-biodegradable
- Poorly recycled

## Muoviongelman ratkaiseminen – 3 tapaa vaikuttaa

1. Muovin pääsy luontoon estettävä  
Lainsäädäntö, asenteet
2. Muovin kierrätys ja kierrätetyn muovin käyttö  
Poltto, kaasutus, depolymerointi
3. Fossiilisten korvaaminen  
Biohajoavat, biopohjaiset, muokatut luonnonpolymeerit

EU, MUOVIJÄTTEEN SYNTYMINEN 2015





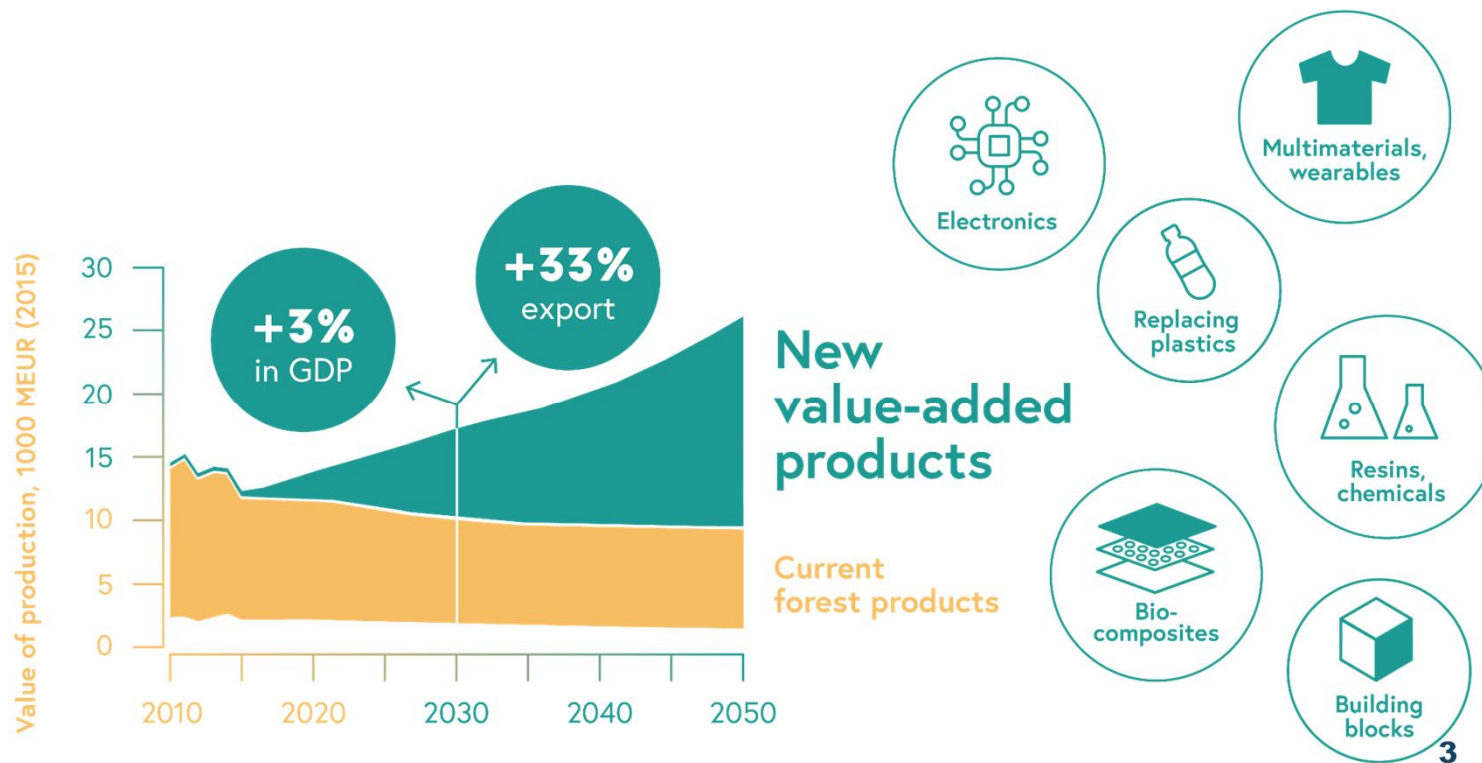
## We aim for solutions

- That look like plastic and perform like plastic, BUT
- Are compostable / recyclable and *made from nature's very own raw materials*



# Metsäteollisuuden lisäarvo voidaan tuplata JA samalla saavuttaa 2050-ilmastotavoitteet!

VTT



# Esimerkkejä uusista lisäarvotuotteista

Puun materiaalikäyttö monipuolistuu. Perinteisten paperi- ja pakkaus- tuotteiden rinnalle syntyy aivan uusia tuotteita ja uutta liiketoimintaa.

## § Lisäarvoinen selluloosa

### • Nanoselluloosa

ü kehitetty teknologia tuottaa nanoselluloosafibrillejä korkeassa sakeudessa

ü lupaavia tuloksia nanoselluloosan sovelluksista elektroniikkaan esim. taipuisissa sensoriratkaisuissa

### • Termoplastinen selluloosa

## § Vaahtorainateknologian kehittäminen

• Uusia mahdollisuuksia sekä uusille että vanhoille paperikoneille

## § Biokomposiitit

• kehitetty teknologioita, joissa voidaan hyödyntää kierrätysmateriaaleja

## § Tekstiilikuitujen kierrätys

• kehitetty teknologia puuvillan kierrätykseen

## § Ligniinin muokkaaminen korkeamman arvon tuotteiksi

• LigniOx – dispergointiaineena esim. sementtiin

• CatLignin – reaktiivinen ligniini hartseihin

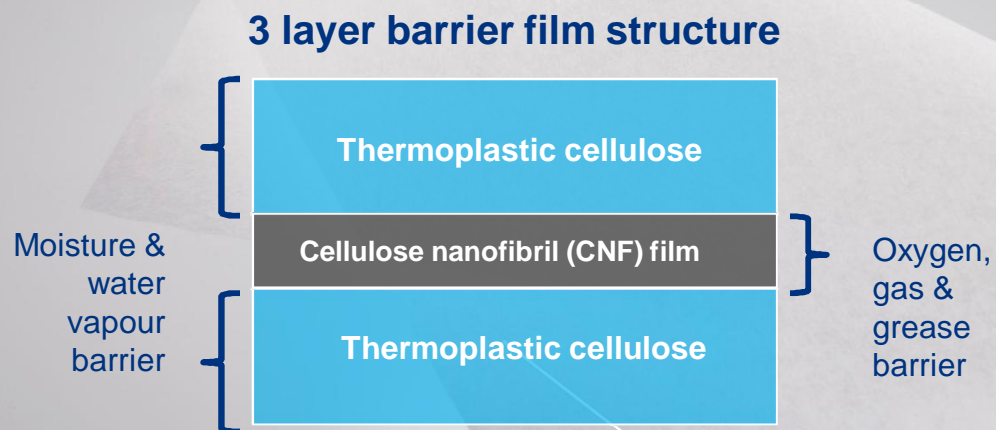




# Packaging solutions



# Transparent pouches for dry food



**100 % RENEWABLE**

**CUSTOMIZABLE**

**HEAT SEALABLE**

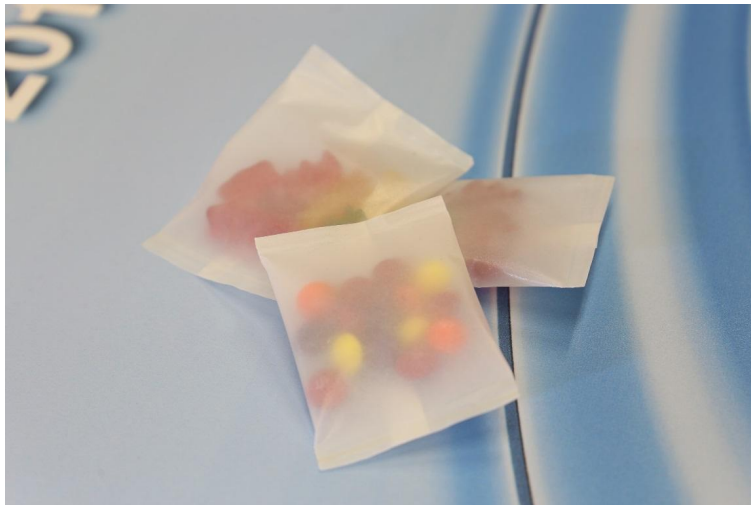
**RECYCLABLE**

Accepts **MULTIPLE BIOBASED RAW MATERIALS** – use of local resources

Processable with **EXISTING MACHINERY**

## Pouch prototypes

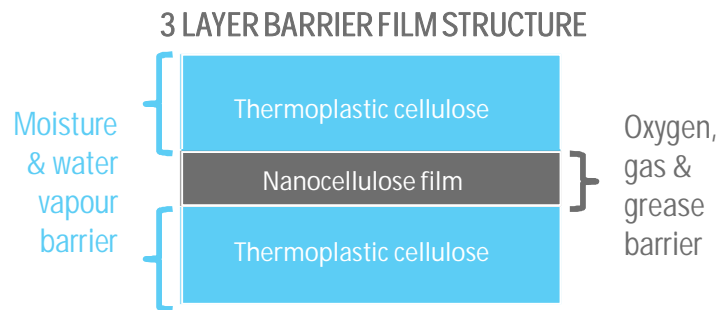
Prototype 1 (1/2018)



Prototype 2 (3/2018)



# BIO-BASED BARRIER SOLUTION FOR SUSTAINABLE PACKAGING



- [Circular Materials Challenge 2018 Award](#), Ellen MacArthur Foundation
- [Ecopack Challenge 2018 Award](#), Packaging Innovations in assoc. with Marks&Spencer
- [Sustainability Awards 2018](#), Finalist Bio-Based Packaging





# Bio-based packaging film

Customer: Welmu International Oy



## CHALLENGE

New bio-based and/or renewable material to replace plastics and to produce clear and biodegradable films in packaging applications.



## SOLUTION

VTT designed material combinations which were tested in pilot environment. A set of prototype films with alternative properties were manufactured.



## BENEFIT

- § Development of novel material with great opportunities on packaging film markets.
- § Decrease amount of plastic waste with non-plastic wrapping film.

*"We chose the unconventional way to do R&D and outsourced it entirely to VTT. It has turned out to be a great decision as we are now on the brink of commercializing our new, revolutionary film material."*

Jaakko Kaminen  
CEO  
Welmu International Oy.

Our wood based biowrap is the future of packaging



# Vaahtorainaus-tekniologian kehittäminen – Uutta elämää paperikoneille



**WOOD FIBRES & FOAM FORMING**  
TO REPLACE NON-RENEWABLE  
PACKAGING MATERIALS?

impossible

A hand holding a pair of black-handled scissors is positioned to cut through the word 'impossible', which is written in a light green, chalk-like font on a dark green chalkboard background. The scissors are open, with the blades pointing upwards and slightly to the left, as if in the middle of a cut. The word 'impossible' is written in a bold, sans-serif font. The background is a solid, dark green color with a slightly textured appearance, resembling a chalkboard.



## Lightweight inner packages

- § Light and soft fibrous cushioning element that protects the product from impacts
- § Product shape made in manufacturing phase



### Foam formed inner packages

Photos: Harri Kiiskinen and Juha Hakulinen VTT

Kiiskinen H., Torniainen E., Kinnunen K., Method of forming a fibrous product, WO 2015/036659 A1



# Material replacing paper and plastic

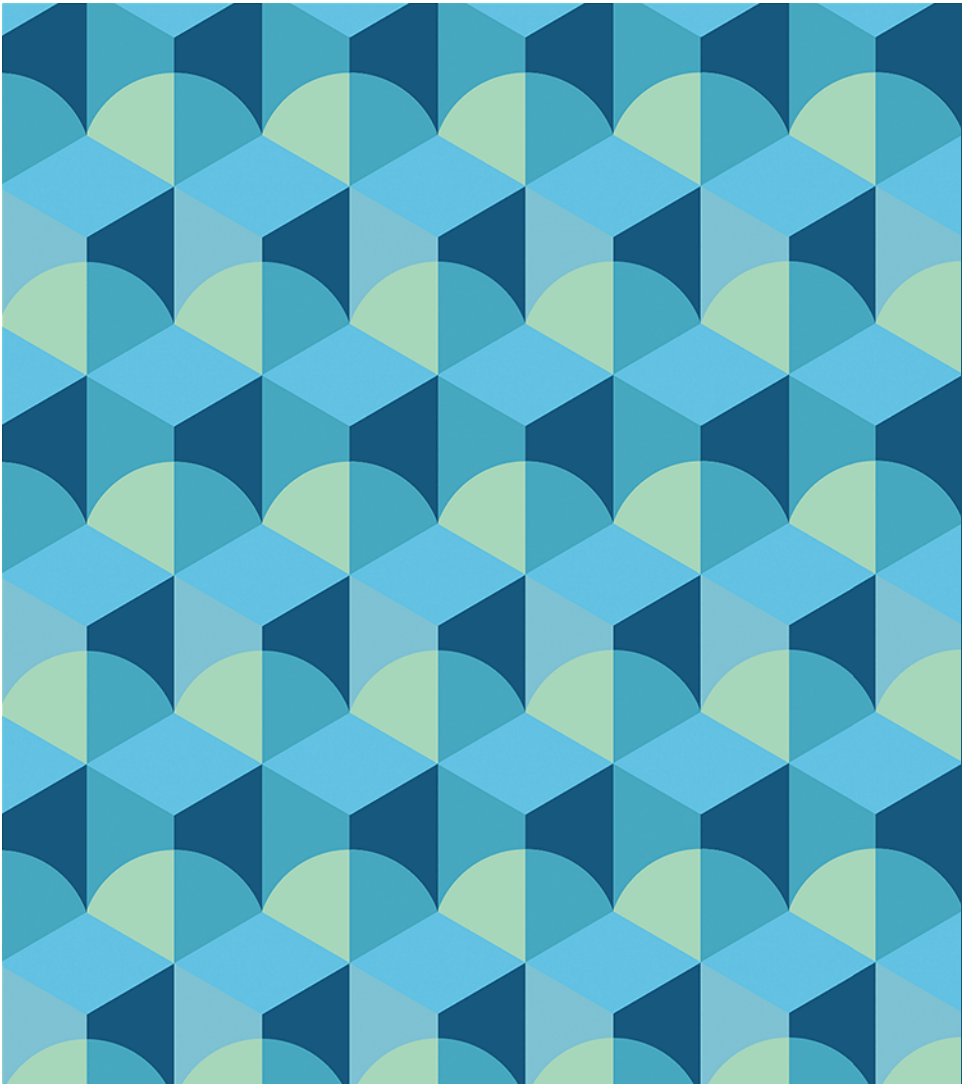
VTT

PAPTIC LTD., A VTT SPIN-OFF COMPANY.

The novel wood fibre-based material PAPTIC® combines the renewability of paper with the resource efficiency and functionality of plastics.

*Biobased product of the Year Europe 2017*



A decorative geometric pattern on the left side of the slide, featuring a repeating arrangement of blue and green diamonds and circles.

# Biopolymer- fibre composites

1.10.2018 VTT – beyond the obvious



# Sustainable light-weight materials

## ? CHALLENGE

Conventional thermoplastic foams are produced from fossil-based materials. Biopolymers and biocomposites are mainly used in unfoamed solutions.

## ✂ SOLUTION

VTT has focused on development of light-weight solutions based on bio-based plastics and cellulose fibre reinforced biocomposites.

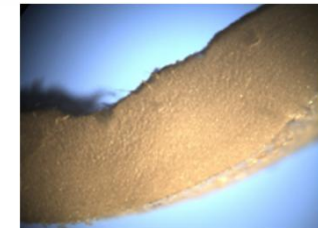
## 👍 BENEFIT

- § Sustainability by replacing fossil-based plastics
- § Up to 100% bio-based compositions
- § Light-weight, insulation properties
- § Applications in packaging, construction and transport



### LIGHT WEIGHT PRODUCT IS COST EFFICIENT:

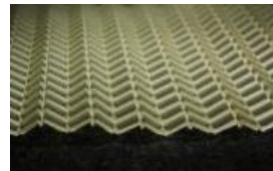
- ✓ LESS RAW MATERIALS
- ✓ LESS ENERGY FOR LOGISTICS
- ✓ LESS RESOURCES FOR DISPOSAL
- ✓ OPTIMISED PERFORMANCE



# Cellulose fibre reinforced thermoformable materials

## ? CHALLENGE

- § Decrease the use of oil based raw materials
- § Increase the use of cellulose based materials
- § Improved stiffness



## 👍 BENEFIT

- § Sustainability by replacing fossil-based plastics
- § Up to 100% bio-based compositions
- § Light-weight
- § Applications in packaging, construction and transport

## 🔧 SOLUTION

Combination of light-weight and cellulose fibre reinforced biocomposite material

For honeycomb cores and thermoformable packaging



Technical University  
of Denmark



# Potential use of paper industry side streams in composites

VTT

## ? CHALLENGE

Significant amounts of valuable components such as fibres and mineral fillers are lost in the form of side streams.

Global demand for sustainable products is steadily increasing and new environmental concerns and waste disposal laws are pushing the industry to find new and alternative uses for waste residues.

## ✂ SOLUTION

Project : EU- Reffibre

The research leading to these results has received funding from the European Community's Seventh Framework Programme under grant agreement n° 604187  
<http://www.ref fibre.eu/>

## 👍 BENEFIT

- § improved composite properties
- § decreased waste generation
- § improved resource efficiency
- § reduced environmental footprint
- § added value for the side streams



**Realised**  
Side streams from paper industry successfully demonstrated as raw material (30 – 50 wt-%) in injection moulded and extruded products

# Totally bio-based injection moulded chair

VTT

## ? CHALLENGE

Bio-based injection mouldable thermoplastic composite material with the focus on high cellulose fibre content, good visual look, improved material performance and competitive price.

## ✂ SOLUTION

VTT developed totally bio-based composite material which were demonstrated in injection moulded chair together with KO-HO Industrial design and Plastec Finland Oy.

Material development was performed by VTT as a part of ACel program in the Clic Innovations Ltd (TEKES).

## 👍 BENEFIT

- § No petroleum based raw materials
- § New additives improves the material properties enabling to meet the material performance targets
- § Material demonstrated in injection moulded end products



KO-HO  
Plastec  
CLIC



100%  
Bio-based  
30%  
Cellulose



An underwater photograph showing a white plastic bag floating in the water above a vibrant coral reef. The bag is crumpled and translucent, with some air trapped inside. The reef below is covered in various types of coral and small fish. The water is clear and blue. A semi-transparent blue horizontal band is overlaid across the middle of the image, containing the text.

Target: our solutions will never become plastic waste